Fig. 1

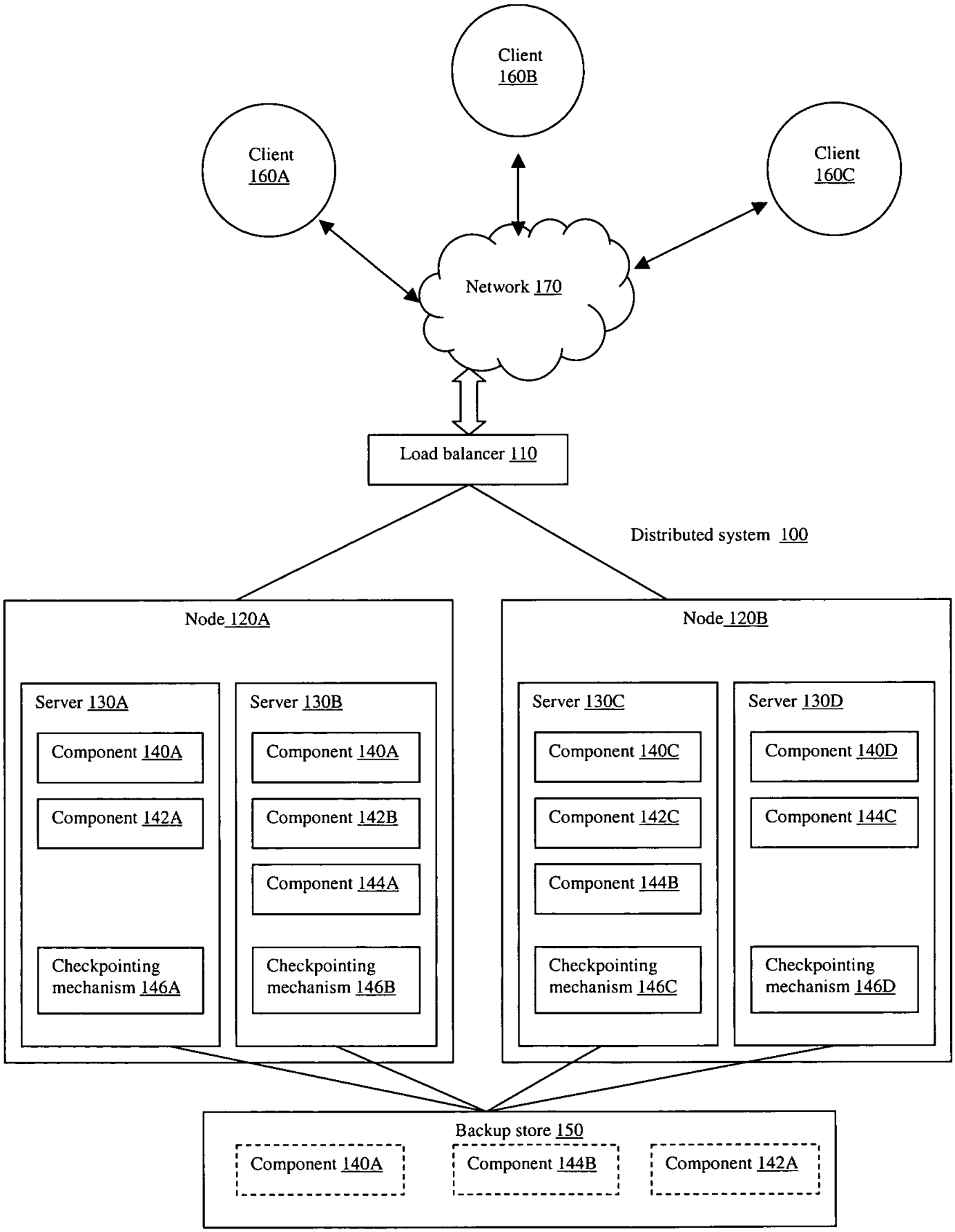

Client 160B
Client 160A
Client 160C
Network 170
Load balancer 110
Distributed system 100
Node 120A
Node 120B
Server 130A
Component 140A
Component 142A
Checkpointing mechanism 146A
Server 130B
Component 140A
Component 142B
Component 144A
Checkpointing mechanism 146B
Server 130C
Component 140C
Component 142C
Component 144B
Checkpointing mechanism 146C
Server 130D
Component 140D
Component 144C
Checkpointing mechanism 146D
Backup store 150
Component 140A
Component 144B
Component 142A

Fig. 2

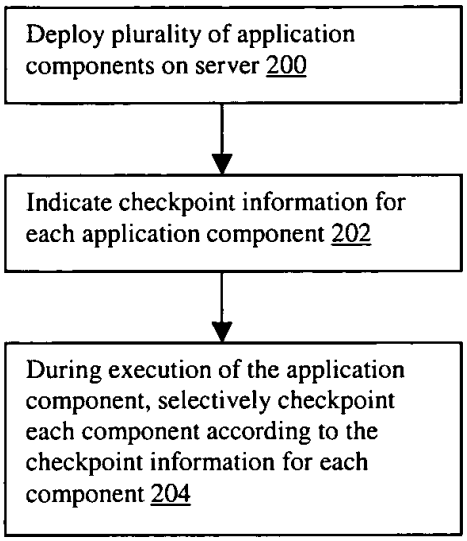

Deploy plurality of application components on server 200
Indicate checkpoint information for each application component 202
During execution of the application component, selectively checkpoint each component according to the checkpoint information for each component 204

Fig. 3

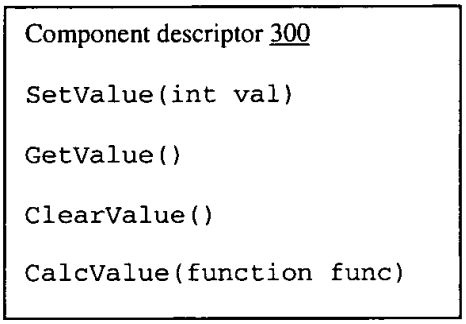
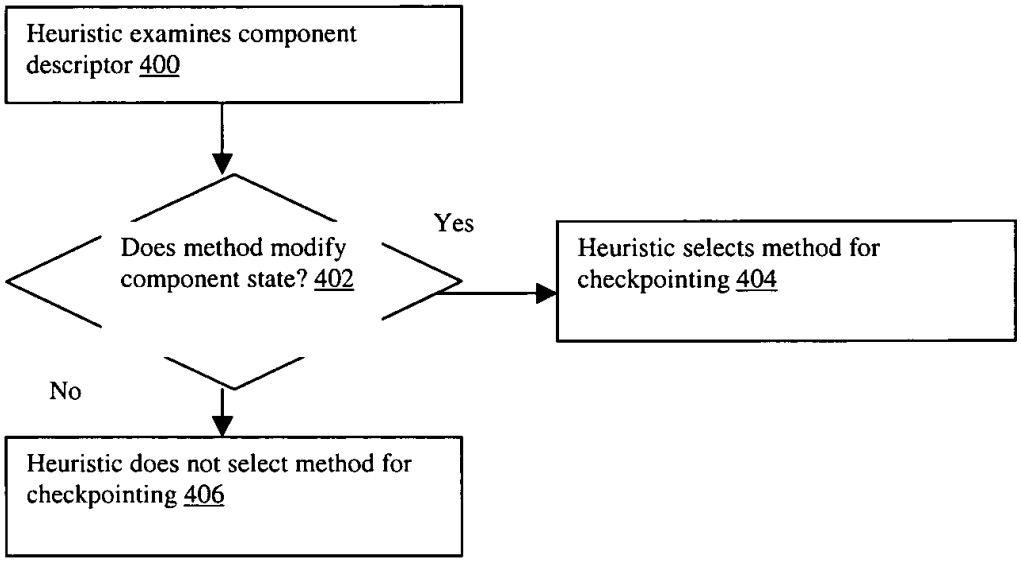

Component descriptor 300
SetValue(int val)
GetValue()
ClearValue()
CalcValue(function func)

Fig. 4


Heuristic examines component descriptor 400
Does method modify component state? 402
Yes
Heuristic selects method for checkpointing 404
No
Heuristic does not select method for checkpointing 406

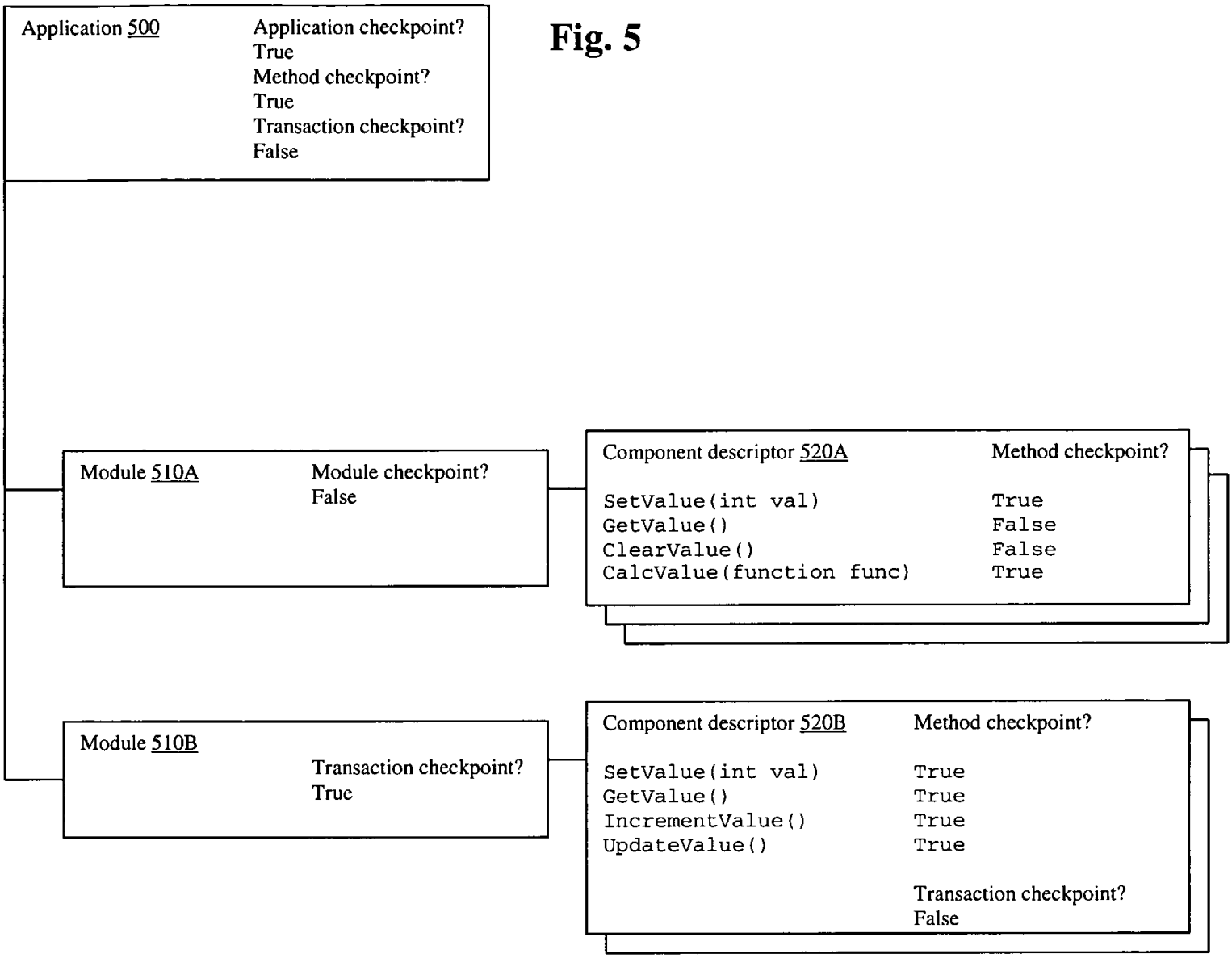

Application 500
Application checkpoint?
True
Method checkpoint?
True
Transaction checkpoint?
False
Module 510A
Module checkpoint?
False
Component descriptor 520A
Method checkpoint?
SetValue(int val)
True
GetValue()
False
ClearValue()
False
CalcValue(function func)
True
Module 510B
Transaction checkpoint?
True
Component descriptor 520B
Method checkpoint?
SetValue(int val)
True
GetValue()
True
IncrementValue()
True
UpdateValue()
True
Transaction checkpoint?
False

Fig. 5

Fig. 6

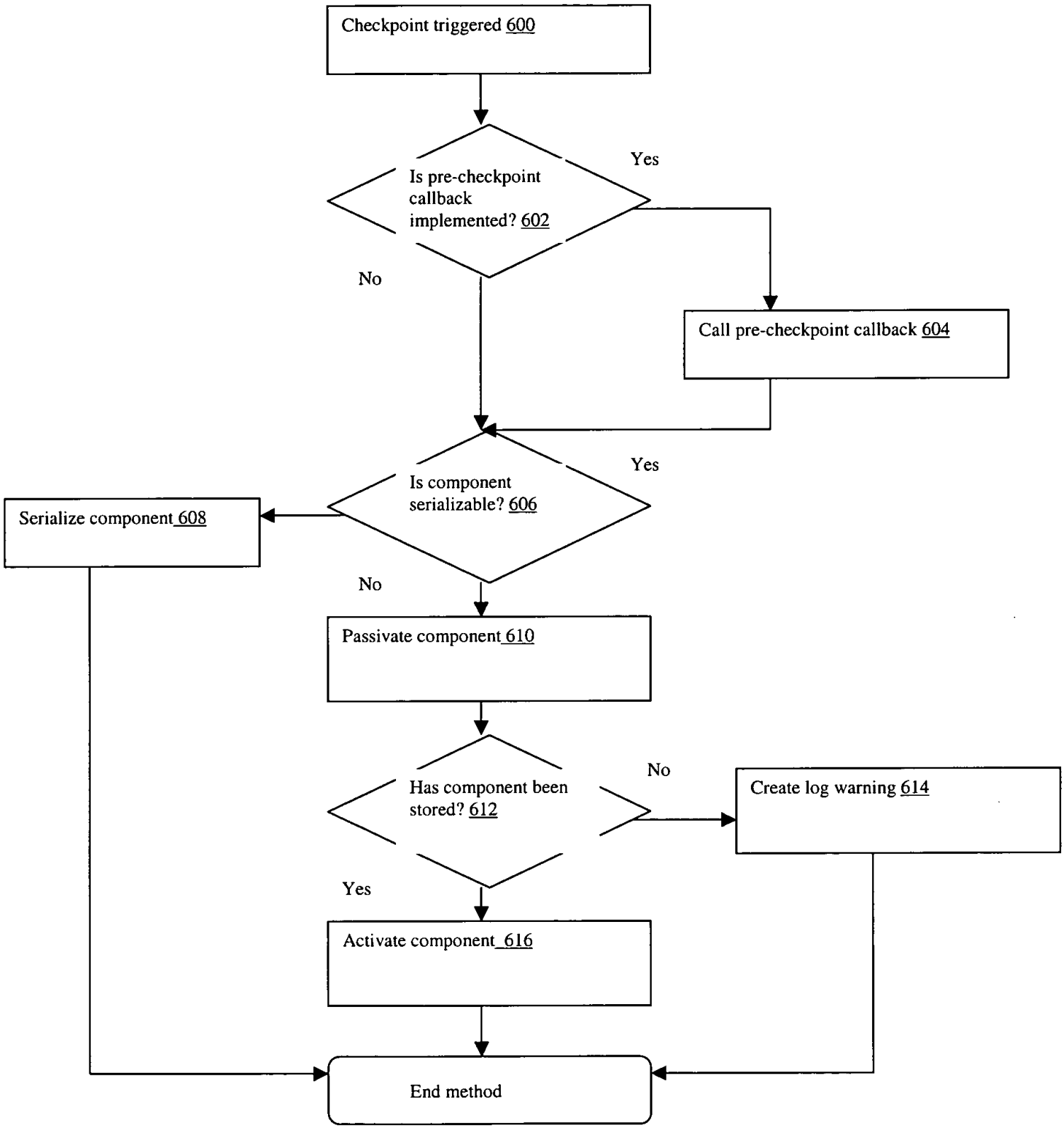

Checkpoint triggered 600
Is pre-checkpoint callback implemented? 602
Yes
No
Call pre-checkpoint callback 604
Is component serializable? 606
Yes
Serialize component 608
No
Passivate component 610
Has component been stored? 612
No
Create log warning 614
Yes
Activate component 616
End method

Fig. 7

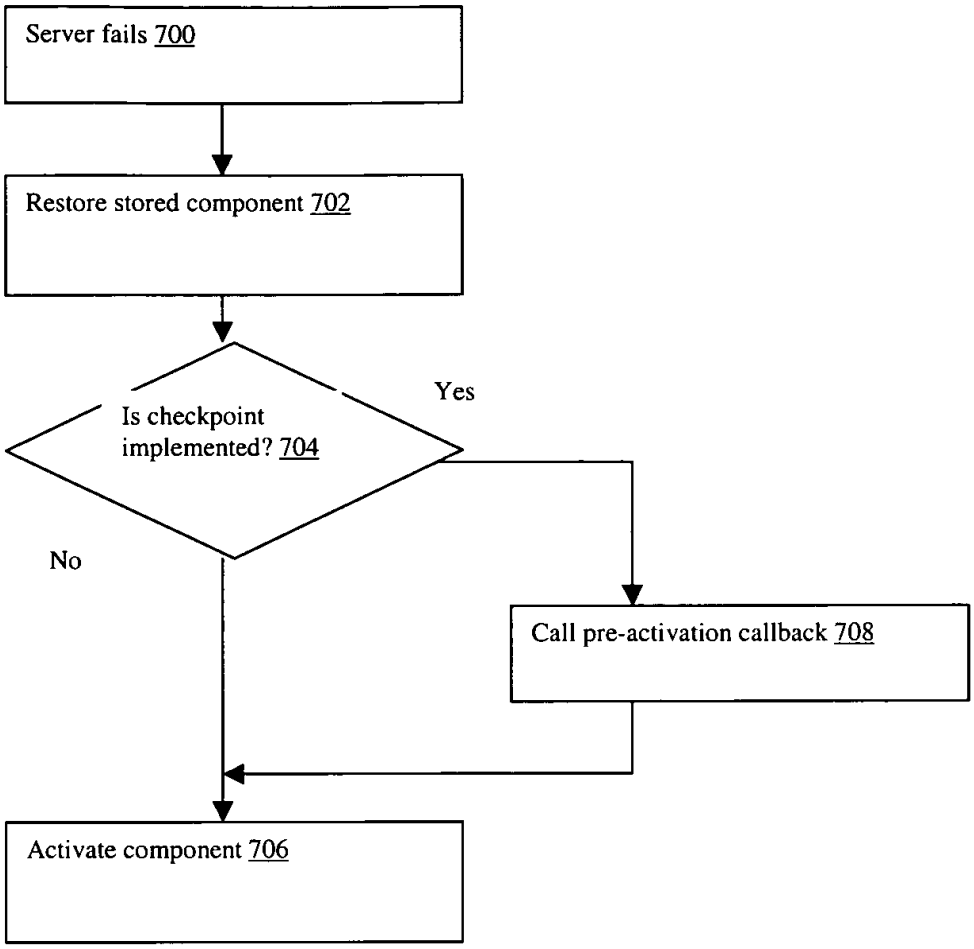
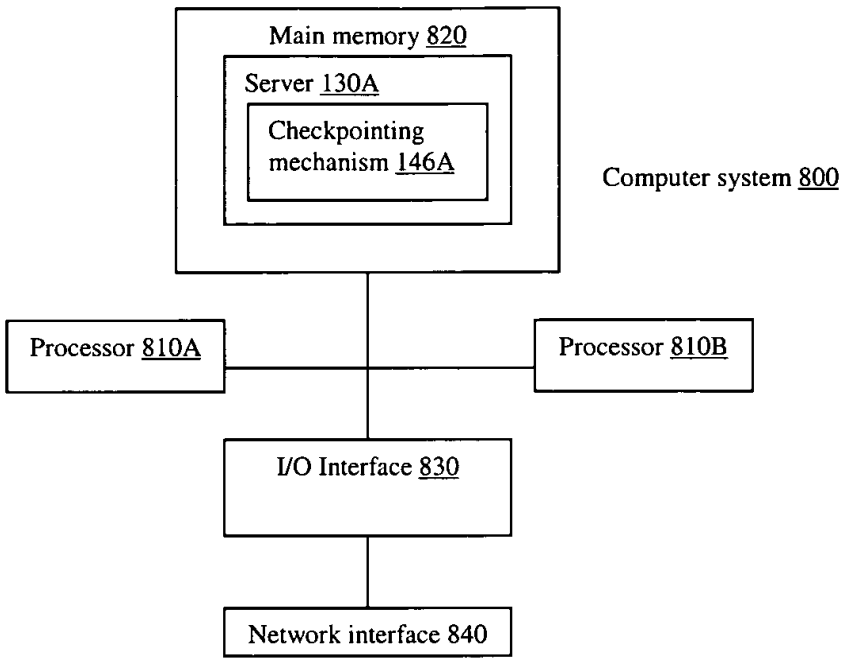

Server fails 700
Restore stored component 702
Is checkpoint implemented? 704
Yes
No
Call pre-activation callback 708
Activate component 706

Fig. 8


Main memory 820
Server 130A
Checkpointing mechanism 146A
Computer system 800
Processor 810A
Processor 810B
I/O Interface 830
Network interface 840